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THE BRAIN OF THE SNAKE-BIRD.

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ON A THREAD-WORM INFESTING THE BRAIN OF THE SNAKE-BIRD.

Plotus anhinga Lin. is generally called "snake-bird" in the States bordering on the Gulf of Mexico, but on the St. John's River in East Florida, where our observations were made during the months of February and March in 1861 and 1867, is more commonly known as the "water-turkey." There they are seen in large numbers, perched upon the dead trunks or projecting limbs of trees which overhang the river or the lakes and lagoons connected with it. On much travelled routes they are shy and wary, and when danger threatens, either fly quietly away or drop head-foremost into the water, and sink almost noiselessly beneath the surface. When they rise again they swim with the head just seen, and when no longer afraid soon show the whole body. With the alligator and loon they seem to have the faculty of quietly raising or sinking their bodies in the water without apparent effort. They seek their food beneath the surface, and, as far as our observations go, live largely on fish, a species of bream (*Pomotis*) being the one most commonly found in their capacious œsophagus and gizzard, and often in such large quantities that one is prepared to accept Mr. Audubon's statement as to the voracity of the *Anhinga*. He also informs us that their food is quite varied, and that they do not hesitate to swallow insects, eggs of frogs, tadpoles, crawfish, shrimps, young alligators, and even small water-snakes. These facts are important in connection with the question as to the source of the parasites with which they are infested.

Mr. Nuttall places the *Anhingas* near the Divers, and Mr. Audubon near the Cormorants, which last they very nearly resemble in many outward characters, as well as in the details of the structure of their

skull. They however differ from both the Divers and Cormorants in their long, snake-like neck, in which respect, as well as in the form of their bills, they resemble the herons. In the dissection of them we were much struck with the peculiar structure of their gizzard. Audubon has given a good figure of the exterior form of this, but has overlooked two remarkable peculiarities:—

1st. The œsophagus has numerous longitudinal folds in its mucous membrane allowing of large dilatation, but has no glandular portion, nor is there any distinct pro-ventriculus. The gastric follicles are all included in a separate, pear-shaped pouch about thirty m. m. in length, and somewhat less in breadth. This does not open into the œsophagus, but directly into the gizzard proper, through the cuticular lining of its upper portion, by a mouth only four or five millimeters in diameter. The follicles are oblong, flask-shaped, the largest of them forming the thickest part of the walls of the pouch, which is near its widest portion, and have a length of five or six millimeters.

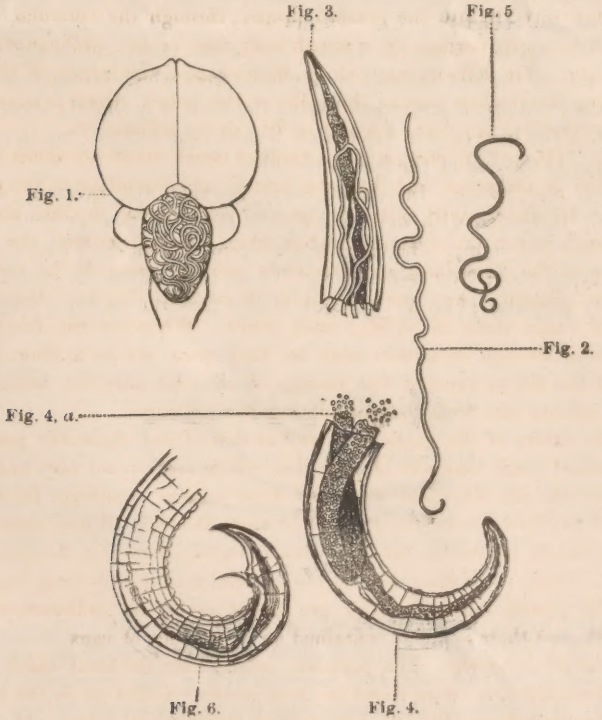
2d. The pyloric portion forms another pouch about seventeen millimeters in diameter, and, like the first, is an appendage to the gizzard. Its whole cavity is densely packed with slender, flexible, horny filaments, seven or eight millimeters long, attached around the entrance of the duodenum, the free ends pointing towards the cavity of the gizzard. Any pressure upon them from this last direction would cause them to overlap each other. Whatever the function of these strange structures may be, they must act as a filter, and could not fail to prevent the passage of all solid particles, unless of very minute size, from the stomach into the intestine.

The cavity of the gizzard, as well as that of the glandular pouch, contained large numbers of parasites, which correspond very nearly, if they are not identical with, the *Eustrongylus papillosus*, Diesing, found by Natterer in the *P. anhinga* from Brazil.[1] While some of them simply adhered to the mucous membrane, others had their heads thrust deeply in, or their bodies were almost concealed by being buried in, the gastric follicles. They are about seventeen millimeters in length, and their oviducts contained an abundance of eggs.

Cranial parasites. The parasites from within the skull which will be described here, were found in every instance coiled up on the back of the cerebellum (Fig. 1), just behind the cerebral lobes, and confined to the texture between the arachnoid and pia mater, but whether

[1] Diesing, Syst. Helminth, Vol. II. p. 326.

originally in the vessels or the meshes of the connective tissue, was not determined. In those cases where the number was large, the parasites were undoubtedly in the latter. The number varied from two to six or eight, or even more, and the two sexes were always present, though not always in equal numbers; in one bird three males and one female, and in another one male and two females were noticed. After a careful search, the parasites were not detected either in other parts of the body or of the brain, than the one indicated. In one instance the mass of worms was such as to produce by pressure a deep indentation of the cerebellum.



The *female* (Fig. 2, natural size) is readily distinguished by being much larger, measures sixty-five millimeters in length, and when fully distended with eggs, has diameter of 0.5 millimeter. The

mouth (Fig. 3) is terminal, without lips or papillæ, the intestine passes in a straight direction to the opposite end of the body, and if it opens at all does so at the point of it, though the opening itself was not distinctly seen (Fig. 4). Several loops of the oviduct are easily observed through the integuments, and one much larger than the rest is seen at the hinder part of the body (Fig. 4, *a*). The genital pore was not found, but is probably in the middle portion of the body, as near the two ends only loops of the oviduct are seen, and these nowhere connected with the walls.

The *male* (Fig. 5, natural size), is only about one-half the linear dimensions of the female, and the hinder portion of the body is always more closely coiled (Fig. 6). The intestine has the same arrangement as in the female. Near the hinder end of the body, and on the concave side of the last half coil, is a papilla from which in one case we saw the male organ protruded, having the form of a slightly recurved spine. The base of this was buried beneath the surface, and in close relation to the end of the spermatic tube.

Eggs and Young. In almost every instance the oviducts were largely distended with ova in different stages of development, and with hatched young. The eggs are of an oval form, their long diameter being about 0.02 millimeter. Those least advanced contained simply granules (Fig. 7, *a*), and others had the embryo roughly

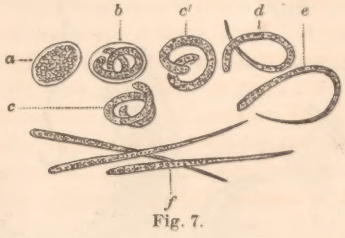


Fig. 7.

sketched by the arrangement of the whole mass of granules in the form of a coiled cylinder of uniform diameter throughout, slightly rounded at the two ends, and invested with a thin membrane (Fig. 7, *b*). It is while in this stage that the embryo leaves the egg, and vast numbers of them were seen without coverings, but still closely coiled (Fig. 7, *c*, *c'*). As they descend towards the lower part of the oviduct they begin to straighten themselves, and at the same time undergo a slight change of form (Fig. 7, *d*, *e*). As the body uncoils,

one end enlarges, and the whole tapers regularly towards the hinder part, and forms an extremely elongated cone (Fig. 7, *f*). When perfectly straight they measure about 0.15 millimetres in length. We were unable to detect any internal organs, if such existed, at any stage of development observed; but, on the contrary, saw nothing but granules, filling the integuments as in the first formation of the embryo.

Parasites have occasionally been found infesting the brain or its membranes in man and animals, but far less frequently than the other regions of the body. The number of species thus far observed is quite small, and are chiefly referable to the genera *Tænia*, *Filaria*, *Trichina* and *Diplostomum*, and confined almost wholly to man and domesticated animals, such as the sheep, reindeer, dromedary, horse and ox, and among wild animals to the chamois, roe-buck, and a few others. That they have not been more frequently seen in the wild species, is without doubt due to the fact that the brains of these have been so seldom examined for the purpose of detecting them.

As soon as attention was directed to the brain of the Anhinga as the seat of parasitism, every opportunity was improved for further examination, and the result is, that the presence of worms in the cranial cavity was proved to be what might be called the normal condition of this bird, since they were detected in seventeen out of nineteen cases. They are found in one single locality, viz.: just behind the cerebral lobes and on the cerebellum, and not elsewhere; they are viviparous and immensely prolific. Their earlier stages are unknown, but the analogy of the Gordiaceous and other worms leads to the supposition that the parasite of the brain of *Anhinga* is one of the migratory kinds, and that a part of its life, at least, is passed in a locality quite different from that in which it was detected. The manner in which the transfer of the embryos is effected outwardly to some other animal, or the water, and then back to another *Anhinga*, is wholly unknown.

Further observations show their presence in 23 or 24 cases out of 27.